

TWR-18248



Teledyne Taber 206-1000 and 2210-3000 Pressure Transducer Proof Test and Burst Test Final Test Report

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National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

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MORTON THIOKOL, INC.

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Space Operations

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TWR-19248

Teledyne Taber 206-1000 and 2210-3000 Pressure Transducer
Proof Test and Burst Test Final Test Report

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INTRODUCTION

The purpose of this test was to verify the range accuracy and structural integrity of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers and to determine if multiple uses have a significant effect on the transducers. Burst pressure for these transducers was also established.

The Teledyne Taber Model 206-1000 pressure transducer is used to measure chamber pressure on full-scale space shuttle solid rocket motors. The Teledyne Taber Model 2210-3000 pressure transducer is used to measure igniter pressure. The Teledyne Taber transducer has very good temperature stability and has been used on all full-scale solid rocket motors, so there is a large data base established using this transducer.

1.1 TEST ITEM DESCRIPTION

Two Teledyne Taber 206-1000 transducers and two 2210-3000 transducers were subjected to all phases of the tests. One transducer of each model number was unused, and the other had multiple uses.

The burst test was conducted in a metal bursting box using a deadweight tester. The vibration test took place at the Morton Thiokol, Inc. vibration facility (T-53). All other testing took place at M-9.

The test item configuration was controlled by WTP-0185 and the applicable documents referenced in that document.

TEST OBJECTIVES

The developmental objectives for this test are as follows:

1. Verify that the measurement of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers will be accurate to ± 2 percent of full scale.
2. Determine whether repeated uses degrade the performance of the transducers.
3. Verify that pressure calibration remains constant following vibration loading specified in this test plan.
4. Determine if the Teledyne Taber 206-1000 and 2210-3000 remain operational following 150 percent of the maximum operational pressure.
5. Determine transducer bursting pressure at ambient temperature.

SUMMARY, CONCLUSIONS, AND RECOMMENDATION

3.1 SUMMARY

Two 206-1000 transducers and two 2210-3000 transducers were subjected to all phases of the tests. One transducer of each model number was new and the other had multiple uses.

All transducers were vibrated in two axis directions for 7g root mean square for 6 min. The 206-1000 transducer was pressurized to 1,000 $\pm 50/-0$ psig and the 2210-3000 transducer was pressurized to 3,000 ± 100 psig during the vibration test.

An 11-point pressure transducer calibration procedure was then completed five times for each transducer. The pressure transducer voltage output was recorded to ± 0.0001 V.

The 150-percent maximum pressure test was run; all transducers were functional during and after the test.

A burst test was then conducted at ambient temperature to verify the structural integrity and to determine the burst strength of the Teledyne Taber transducers. The 206-1000 transducers were pressurized to 1,500 psig and the 2210-3000 transducer to 4,500 psig.

3.2 CONCLUSIONS

The following is a one-on-one correlation of development objectives with test results. Detailed results can be found in the sections referenced in parenthesis.

<u>Objective</u>	<u>Results</u>
1. Verify that the measurement of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers will be accurate to ± 2 percent of full scale.	The measurements of the 206-1000 and 2210-3000 were accurate to ± 2 percent full scale. (6.2)

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Objective

2. Determine whether repeated uses degrade the performance of the transducers.
3. Verify that pressure calibration remains constant following vibration loading specified in this test plan.
4. Determine if the Teledyne Taber 206-1000 and 2210-3000 remain operational following 150 percent of the maximum operational pressure.
5. Determine transducer bursting pressure at ambient temperature.

Results

Repeated uses do not degrade the performance of the transducers. (6.3, 6.4)

Pressure calibration remained constant after vibration loading. (6.1)

All transducers remained operational following 150-percent maximum pressure test. (6.3)

Determined--See table in Section 6.4.3 for specific values.

3.3 RECOMMENDATION

Burst Test

Cap screw torque on all 206-1000 transducers should be checked in subsequent tests.

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INSTRUMENTATION

Standard laboratory equipment traceable to NBS was used to support this test. All instrumentation was calibrated in accordance with MIL-STD-45662. All instruments were calibrated and recorded before and after each test. Lab standards were used during pressure calibration tests.

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PHOTOGRAPHY

Prior to testing, still color photographs were taken of the test item assembly and typical instrumentation. Post-test photographs were required for test documentation.

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TEST RESULTS AND DISCUSSION

6.1 RANDOM VIBRATION TEST

6.1.1 Introduction

A random vibration test was performed at T-53 to verify the structural integrity of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers. For the random vibration test, the 206-1000 transducer was assembled to the 1U50731-09 configuration, and the 2210-3000 transducer was assembled to the 1U50731-12 configuration.

Each transducer was subjected to random vibration at 7g root mean square for 6 min following the vibration criteria listed below (refer to SE-019-049-2H). The 206-1000 transducer was pressurized to 1,000 +50/-0 psig and the 2210-3000 transducer was pressurized to 3,000 ±100 psig during the vibration test.

20 - 50 Hz at 0.020 g²/Hz
50 - 150 Hz at +3 dB/oct
150 - 500 Hz at 0.060 g²/Hz
500 - 2,000 Hz at -6 dB/oct
2,000 Hz at 0.0038 g²/Hz

The test was performed in the two axis directions (longitudinal and lateral).

Vibration was recorded and verified by T-53 personnel to be within the criteria listed above.

6.1.2 Objective

The vibration test was run to support the following test objective:

Verify that pressure calibration remains constant following vibration loading specified in this test plan.

6.1.3 Results and Discussion

The vibration test verified the structural integrity of the Teledyne Taber transducers. The 206-1000 transducer maintained a pressure of 1,000 psi and

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the 2210-3000 transducer maintained a pressure of 3,000 psi during vibration loading with no visible leakage occurring.

The gage was verified to be functional following this test during the 150-percent overpressure test documented in Section 6.3 of this report. Pressure calibration change was negligible after the vibration test (Appendix A).

6.2 PRESSURE CALIBRATION

6.2.1 Introduction

An 11-point pressure transducer calibration procedure was completed five times for each transducer. The pressure transducer voltage output was recorded to ± 0.0001 V.

1. Ten Vdc were applied to input of pressure transducer. Pressure transducer voltage output and lab standard pressure were recorded. This was performed before and after 150-percent maximum pressure test.
2. Pressure was increased from 0 to 1,000 psig for the 206-1000 transducer and from 0 to 3,000 psig for the 2210-3000 transducer in 200-psi increments. Lab standard pressure and pressure transducer voltage output were recorded at each 200-psi increment.
3. Pressure was decreased back to 0 psig in 200-psi increments. Lab standard pressure and pressure transducer voltage output was recorded at each 200-psi increment.

6.2.2 Objective

The pressure calibration was run to support the following test objective:

Verify the measurement of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers will be accurate to ± 2 percent of full scale.

6.2.3 Results and Discussion

The Teledyne Taber 206-1000 and 2210-3000 pressure transducers were verified to be accurate to ± 2 percent full scale (Appendix B).

6.3 150-PERCENT MAXIMUM PRESSURE TEST

6.3.1 Introduction

Ten-Vdc input was applied to each pressure transducer. Pressure was increased to 1,500 psig for the 206-1000 transducer and 4,500 psig for the 2210-3000 transducer. Pressure transducer voltage output versus time and lab standard pressure versus time were recorded. The pressure calibration test, as outlined in Section 6.2.1, was repeated.

6.3.2 Objectives

The 150-percent maximum pressure test was run to support the following test objectives:

Determine whether repeated uses degrade the performance of the transducers.

Determine if the Teledyne Taber 206-1000 and 2210-3000 remain operational following 150 percent of the maximum operational pressure.

6.3.3 Results and Discussion

All transducers remained functional for the duration of the test; the reading returned to zero following the test (Figures 1 through 4). No leakage was noted. The transducers were recalibrated after the maximum pressure test; the change was negligible (Appendix C).

6.4 BURST TEST

6.4.1 Introduction

All transducers were subjected to this test. A burst test was conducted at ambient temperature to verify the structural integrity and to determine the burst strength of the Teledyne Taber transducers. The transducers were installed in the metal bursting box. The 206-1000 transducers were pressurized to 1,500 psig and the 2210-3000 transducers to 4,500 psig. Pressure was increased in 500-psi increments until burst occurred.

6.4.2 Objectives

The burst tests were performed to support the following objectives:

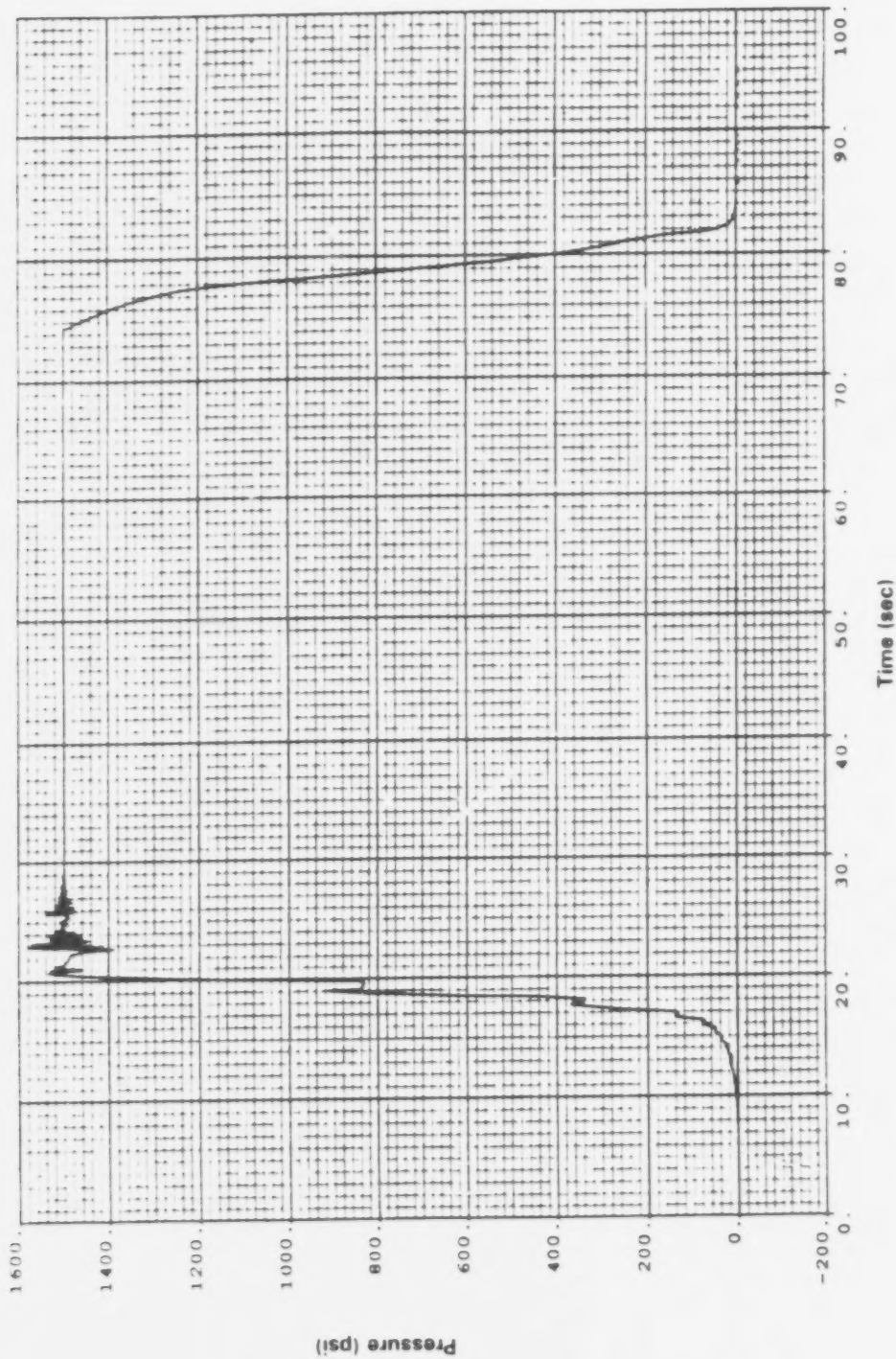


Figure 1. 150-Percent Pressure Transducer Proof Test (Model 206 - S/N 870222)

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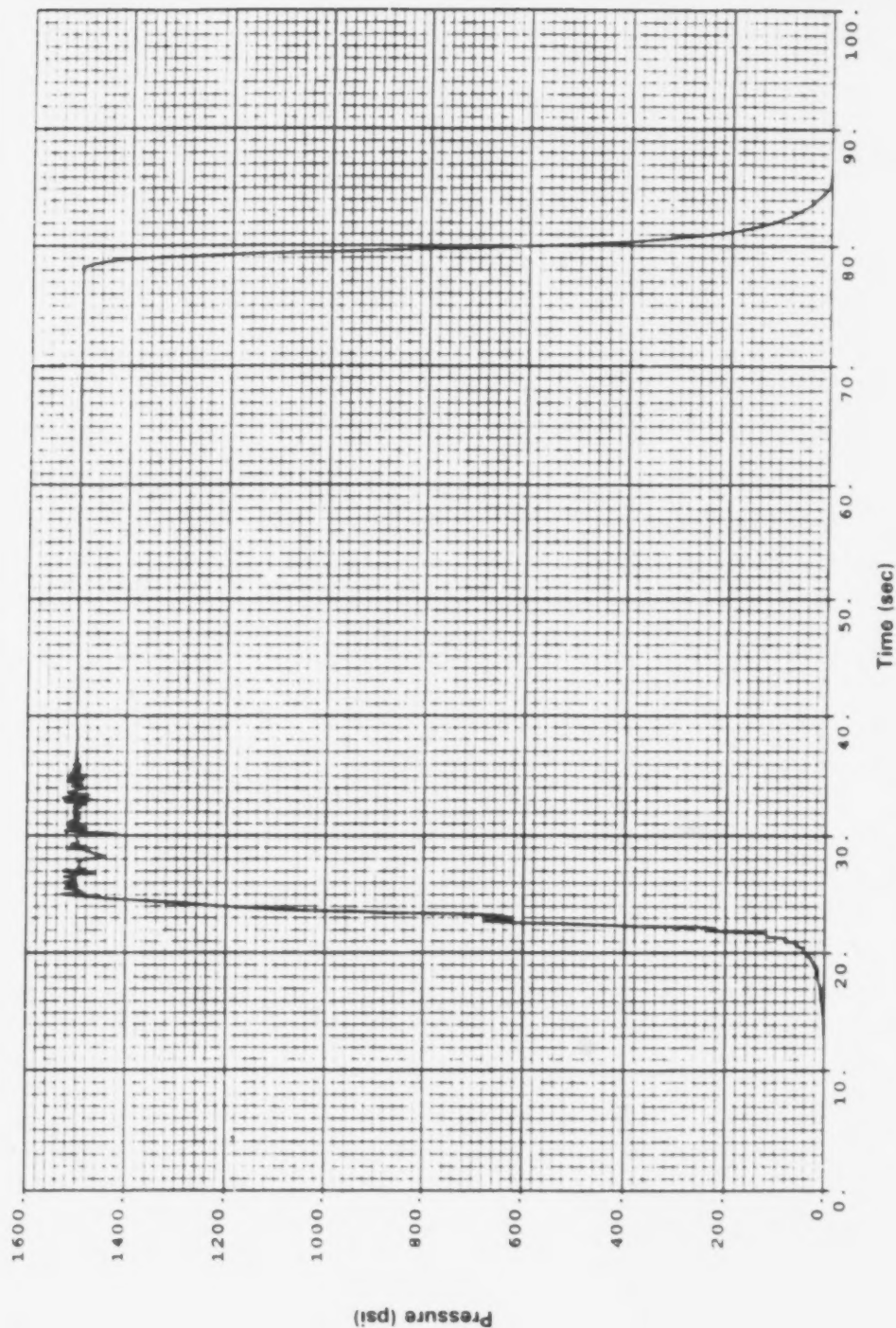


Figure 2. 150-Percent Pressure Transducer Proof Test (Model 206 - S/N 848504)

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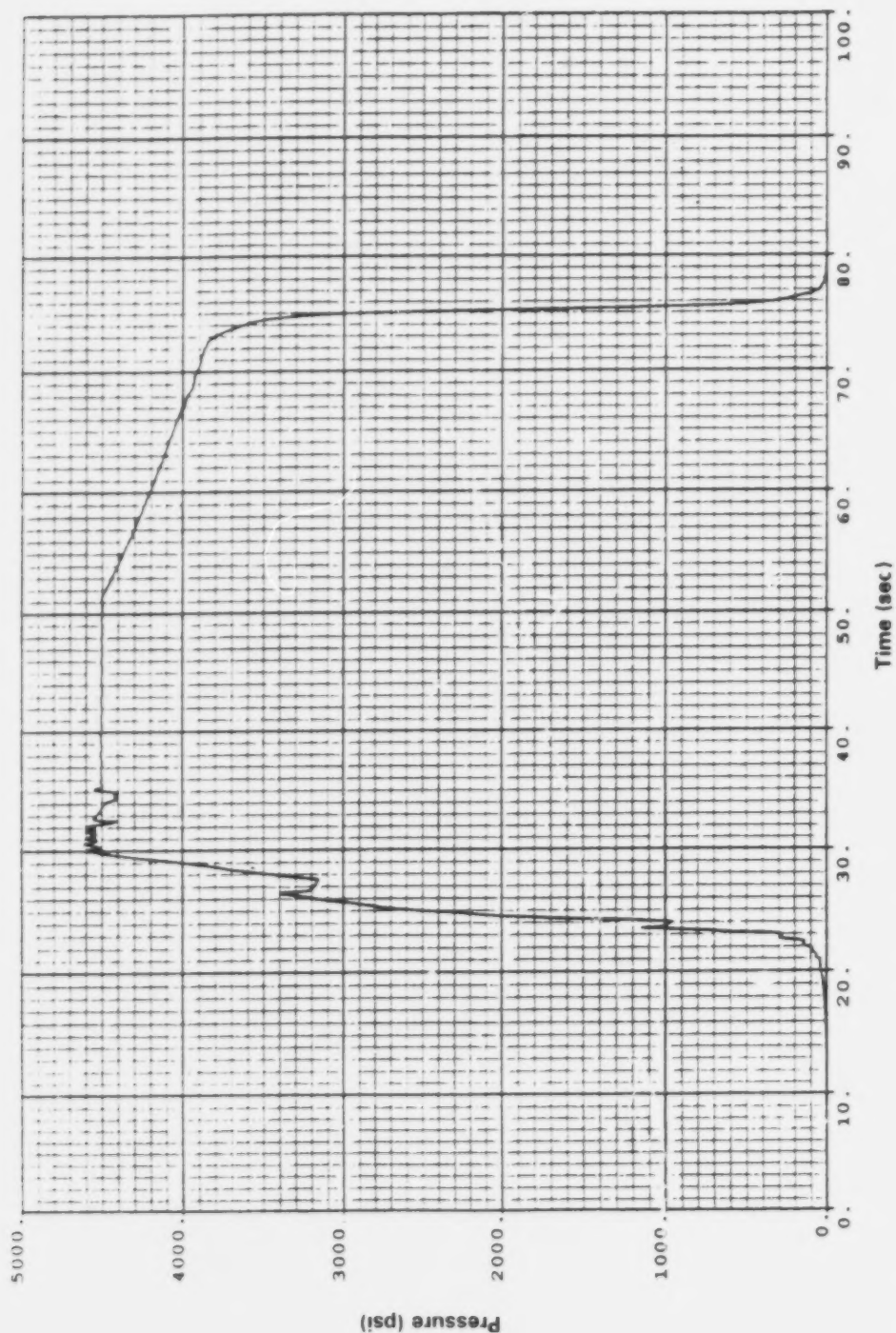


Figure 3. 150-Percent Pressure Transducer Proof Test (Model 2210 - S/N 842258)

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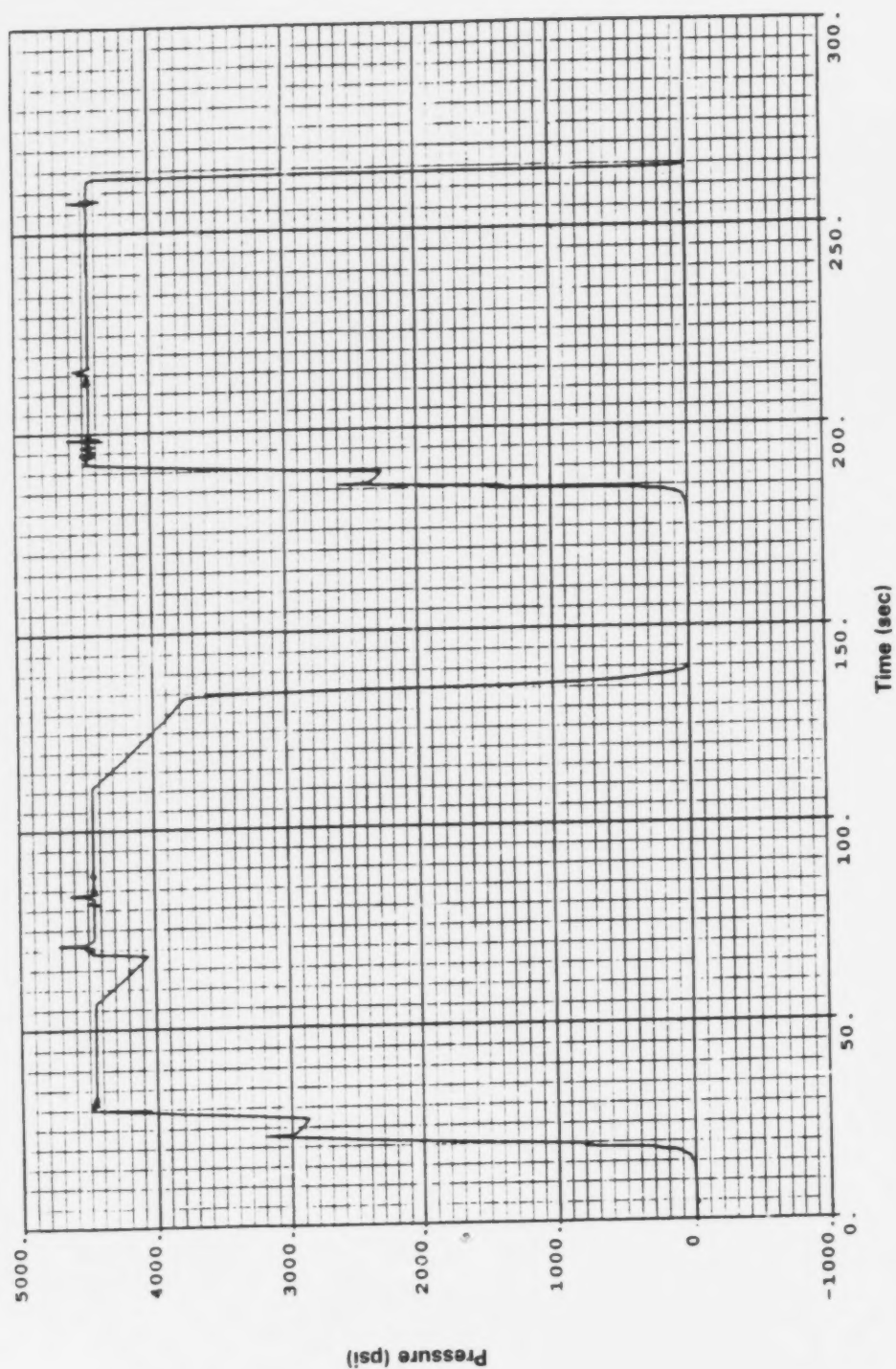


Figure 4. 150-Percent Pressure Transducer Proof Test (Model 2210 - S/N 882181)

Determine whether repeated uses degrade the performance of the transducers.

Determine transducer bursting pressure at ambient temperature.

6.4.3 Results and Discussion

The burst pressure traces are shown in Figures 5 through 8. Repeated uses do not degrade the performance of the transducers, as shown by the bursting pressures. Burst test results are listed in the table below.

Burst Test Results

<u>Model No.</u>	<u>S/N</u>	<u>Pressure Rating (psi)</u>	<u>Previous Uses</u>	<u>Burst Pressure (psi)</u>
206-1000	870222	1,000	Multiple	11,259
206-1000	848504	1,000	None	10,577
2210-3000	842258	3,000	Multiple	18,055
2210-3000	882181	3,000	None	18,088

The failure modes are listed below.

2210-3000--The diaphragm ruptured, followed by the electrical connector being blown out of the case.

206-1000--A leak developed between the diaphragm cap and the transducer body joint. No damage was apparent after disassembly.

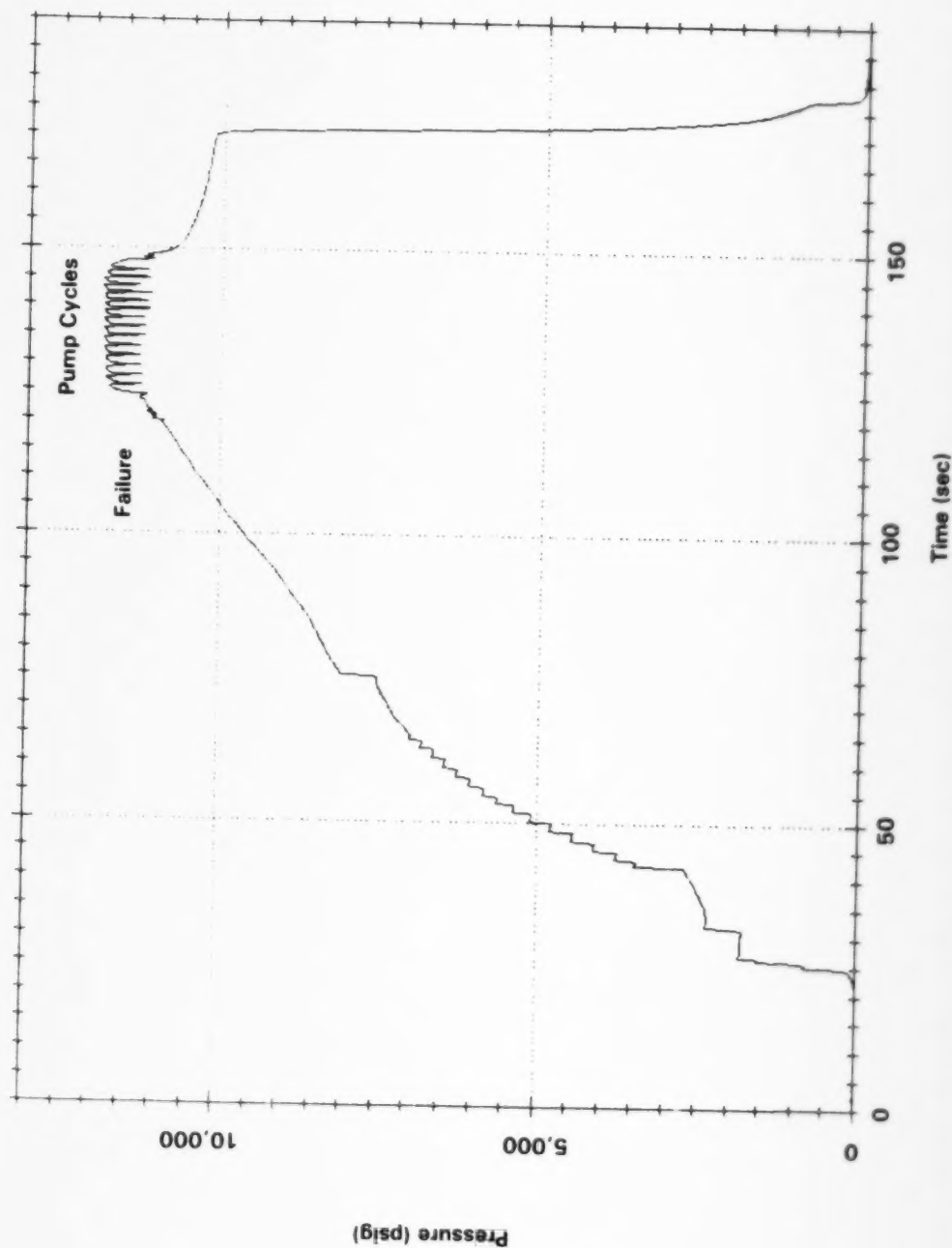


Figure 5. Burst Pressure (Model 206 - S/N 870222)

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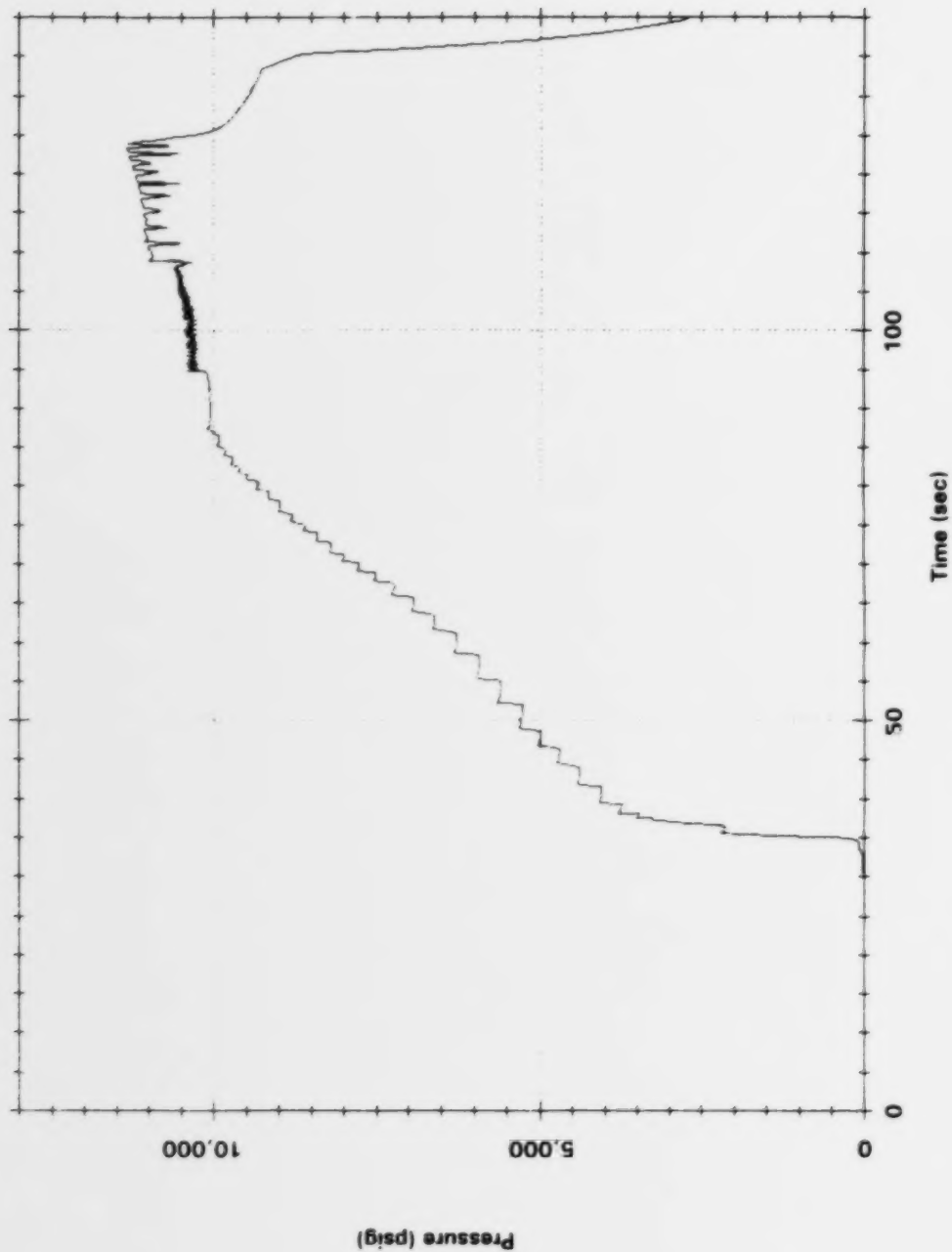


Figure 6. Burst Pressure (Model 206 - S/N 848504)

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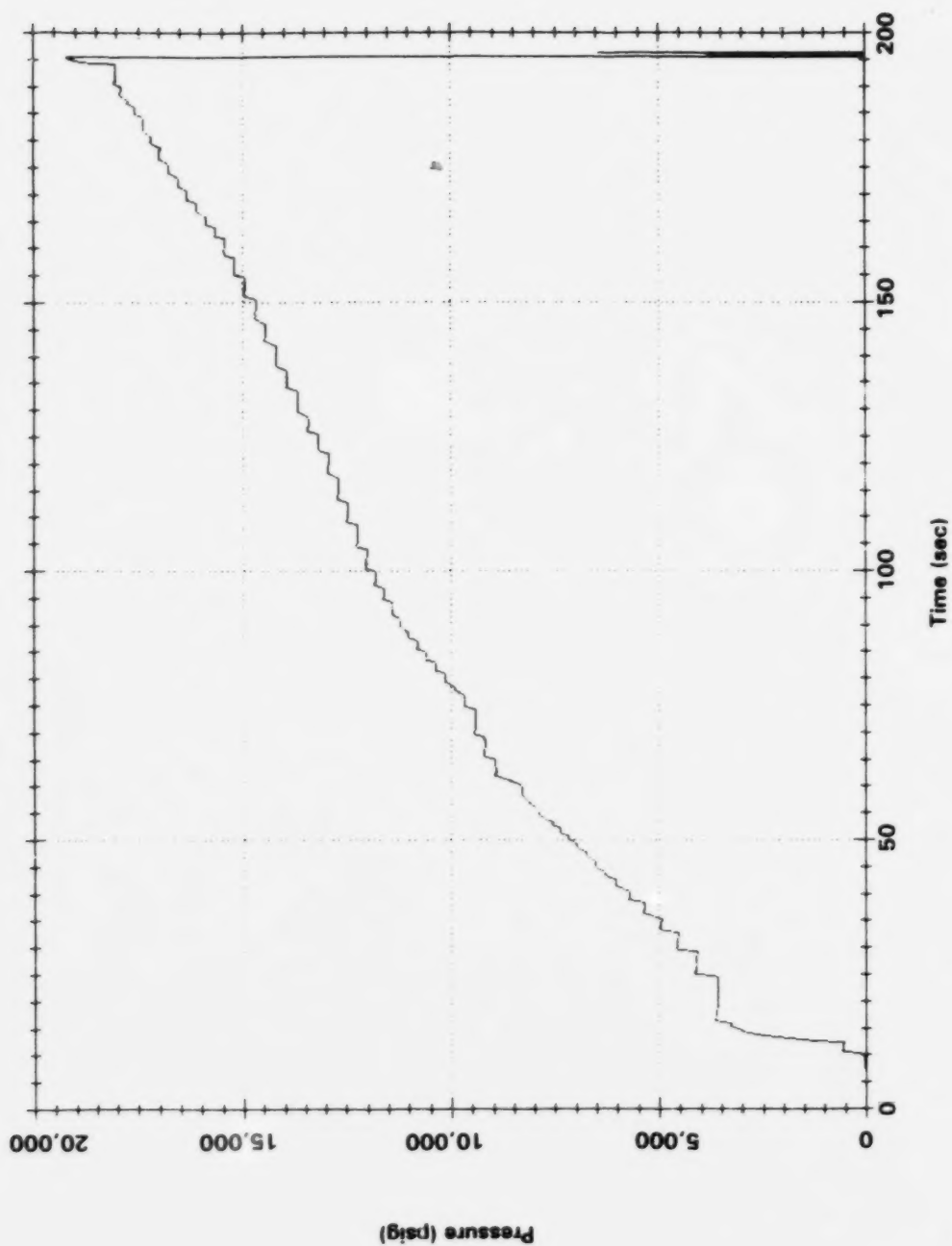


Figure 7. Burst Pressure (Model 2210 - S/N 842258)

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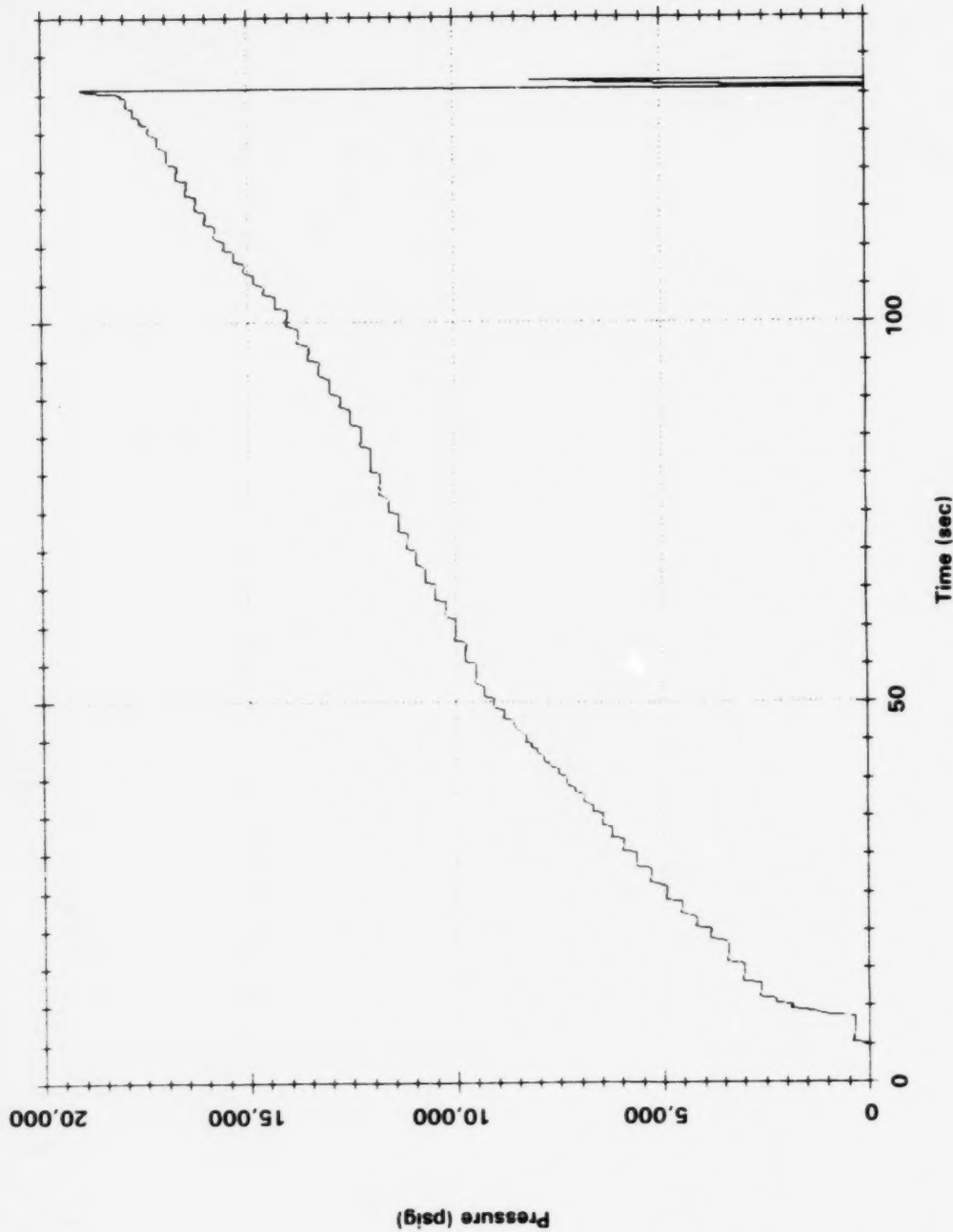


Figure 8. Burst Pressure (Model 2210 - S/N 882181)

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APPLICABLE DOCUMENTS

WTP-0185	Teledyne Taber 206-1000 and 2210-3000 Pressure Transducer Proof Test and Burst Test Final Test Report
MIL-STD-45662	Calibration Systems Requirements
SE-019-049-2H	Solid Rocket Booster Vibration, Acoustic and Shock Design and Test Criteria
1050731	Transducer Bolt Assembly

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Appendix A
Pressure Calibration After Vibration Test

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TRANSDUCER CALIBRATION WORKSHEET

DESCENDING

				STEPS	SHUNTS	% OF F.S.
MANUFACTURER TABER	MODEL 2210	SERIAL NO. 882181	RANGE 3000	1		
CHANNEL	CALIBRATION DATE 15 FEB 89	EXCITATION 10.00 VDC	LOADING INSTRUMENT 16856	2		
BAROMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24930	3		
LOADING TECH. 16783	RECORDING TECH. 16783	COMPUTING TECH.	PEAK OUT	4		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP.						

APPLIED LOAD %	PSI	MV OUTPUT				AVERAGE	% OF F.S.	LIN	HYS
Z OUT	input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	3000	29.984	29.979	29.991	29.983	29.980			
20	2800	28.027	27.996	28.005	27.995	28.002			
40	2600	26.032	26.025	26.024	26.022	26.024			
60	2400	23.973	24.030	24.037	24.029	24.031			
80	2200	22.043	22.046	22.047	22.045	22.037			
100	2000	20.043	20.053	20.053	20.050	20.054			
80	1800	18.052	18.059	18.056	18.061	18.054			
60	1600	16.058	16.059	16.059	16.062	16.059			
40	1400	14.043	14.061	14.058	14.062	14.059			
20	1200	12.054	12.056	12.055	12.060	12.055			
0	1000	10.053	10.052	10.051	10.057	10.053			
-20	800	8.047	8.046	8.046	8.049	8.047			
-40	600	6.040	6.036	6.037	6.041	6.037			
-60	400	4.029	4.027	4.028	4.029	4.026			
-80	200	2.018	2.014	2.104	2.016	2.013			
-100	0	.0000	.0000	.0000	.0003	.0001			
-80									
-60									
-40									
-20									
-0									
Z OUT									

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER
MODEL#: 206
SERIAL#: 848504
RANGE: 1000 PSIG
DATE: 16 FEB 89
SL#: N/A
READOUT: 24930
MODE: POS
REF STD: 16856
SHUNTS: 3 MV/V
INS RES: 10K MEG OHMS
3 MV/V SHUNTS -ZERO %F.S. SH/LIN
ZERO= 0.000 0.000
#1 = 7.528 .528 25.08 25.01
#2 = 15.055 15.055 50.15 50.06
#3 = 22.581 22.581 75.22 75.15
#4 = 30.103 30.103 100.28 100.27
TEMP. DEG. F = 75
EXCITATION = 9.9994 V.DC
SENSITIVITY = 3.002 MV/V
POT OUT = 0.2720 MV
CONVERSION FACTOR = 3.33133453

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%	0.001	0.000	0.000	0.000	0.000	0.00	
20%	6.012	6.016	6.015	6.014	6.014	20.03	
40%	12.030	12.034	12.031	12.032	12.031	40.08	
60%	18.039	18.041	18.047	18.042	18.042	60.10	
80%	24.042	24.040	24.039	24.040	24.040	80.09	
100%	30.025	30.023	30.007	30.018	30.018	100.00	
80%	24.069	24.060	24.061	24.063	24.063	80.16	0.07
60%	18.059	18.051	18.060	18.057	18.056	60.15	0.05
40%	12.041	12.043	12.045	12.043	12.043	40.12	0.04
20%	6.018	6.019	6.017	6.018	6.018	20.05	0.02
0%	0.000	0.001	-0.002	0.000	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.858E-03 B=.301404 C= -1.149E-05
RR= .999999838



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER MANUFACTURER	206 MODEL #	848504 SERIAL #	16 FEB 89 DATE/APPROVAL
1000 PSIG RANGE	N/A SL # / MODE	9.9994 EXCITATION V.DC.	3.002 MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL
SIMULATION

#1 = 25.01
#2 = 50.06
#3 = 75.15
#4 = 100.27

LINEARITY

100% = 100.00
80% = 80.09
60% = 60.10
40% = 40.08
20% = 20.03

HYSTERESIS

80% = 0.07
60% = 0.05
40% = 0.04
20% = 0.02
0% = 0.00

TRANSDUCER WORKSHEET I AP 28 A1

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	848504	#1 =	7.526	7.526	25.08 25.01
RANGE:	1000 PSIG	#2 =	15.053	15.053	50.16 50.07
DATE:	16 FEB 89	#3 =	22.578	22.578	75.23 75.16
SL#:	N/A	#4 =	30.102	30.102	100.31 100.29
READOUT:	24930	TEMP. DEG. F = 75			
MODE:	POS	EXCITATION = 9.9992 V.DC			
REF. STD:	16856	SENSITIVITY = 3.001 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.2770 MV			
INS. RES. >10K	MEG OHMS	CONVERSION FACTOR = 3.33218558			

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0% =	0.000	0.001	0.000	0.000	0.000	0.00	
20% =	6.011	6.014	6.016	6.014	6.013	20.04	
40% =	12.029	12.028	12.026	12.028	12.027	40.08	
60% =	18.034	18.029	18.037	18.033	18.033	60.09	
80% =	24.035	24.043	24.042	24.040	24.040	80.10	
100% =	29.998	30.017	30.017	30.011	30.010	100.00	
80% =	24.055	24.061	24.055	24.057	24.057	80.16	0.06
60% =	18.057	18.060	18.054	18.057	18.057	60.17	0.08
40% =	12.039	12.036	12.036	12.037	12.037	40.11	0.03
20% =	6.018	6.015	6.019	6.017	6.017	20.05	0.01
0% =	0.000	-0.002	0.001	0.000	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.572E-03 B=.301278 C= -1.084E-05
RR= .999999714



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	848504	16 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A	POS	9.9992
RANGE	SL # / MODE	EXCITATION V.DC.	3.001 3
			MV/V SENS. / MV/V SHUNT MOD.

ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100% = 100.00	80% = 0.06
#1 = 25.01	80% = 80.10	60% = 0.08
#2 = 50.07	60% = 60.09	40% = 0.03
#3 = 75.16	40% = 40.08	20% = 0.01
#4 = 100.29	20% = 20.04	0% = 0.00

TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#: 206	ZERO= 0.000	0.000		
SERIAL#: 870222	#1 = 7.513	7.513	25.04	25.02
RANGE: 1000 PSIG	#2 = 15.024	15.024	50.08	50.04
DATE: 16 FEB 89	#3 = 22.536	22.536	75.12	75.09
SL#: N/A	#4 = 30.049	30.049	100.16	100.15
READOUT: 24412	TEMP. DEG.F = 75			
MODE: POS	EXCITATION = 10.0015 V.DC			
REF.STD: 16856	SENSITIVITY = 3.000 MV/V			
SHUNTS: 3 MV/V	POT OUT = 0.3260 MV			
INS.RES. >10K MEG OHMS	CONVERSION FACTOR = 3.33333333			

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.002	6.003	6.003	6.003	6.003	20.01	
40%=	12.007	12.007	12.009	12.008	12.008	40.03	
60%=	18.011	18.008	18.014	18.011	18.011	60.04	
80%=	24.011	24.021	24.017	24.016	24.016	80.05	
100%=	29.996	29.997	30.007	30.000	30.000	100.00	
80%=	24.030	24.032	24.028	24.030	24.030	80.10	0.05
60%=	18.026	18.031	18.030	18.029	18.029	60.10	0.06
40%=	12.014	12.015	12.014	12.014	12.014	40.05	0.02
20%=	6.002	6.004	6.005	6.004	6.004	20.01	0.00
0%=	-0.002	0.000	-0.002	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-2.465E-03 B=.300481 C= -4.19E-06
RR= .999999865



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	870222	16 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A	POS	10.0015
RANGE	SL # / MODE	EXCITATION V.DC.	3.000 3
			MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100%= 100.00	80%= 0.05
#1 = 25.02	80%= 80.05	60%= 0.06
#2 = 50.04	60%= 60.04	40%= 0.02
#3 = 75.09	40%= 40.03	20%= 0.00
#4 = 100.15	20%= 20.01	0%= 0.00

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER
MODEL#: 206
SERIAL#: 870222
RANGE: 1000 PSIG
DATE: 16 FEB 89
SL#: N/A
READOUT: 24412

3 MV/V SHUNTS -ZERO %F.S. SH/LIN
ZERO= 0.000 0.000
#1 = 7.513 7.513 25.04 25.02
#2 = 15.024 15.024 50.06 50.04
#3 = 22.538 22.538 75.10 75.08
#4 = 30.051 30.051 100.14 100.14
TEMP.DEG.F = 75
EXCITATION = 10.0017 V.DC
SENSITIVITY = 3.000 MV/V
POT OUT = 0.3130 Mv
CONVERSION FACTOR = 3.333333

MODE: POS
REF STD: 16856
SHUNTS: 3 MV/V
INS. RES: 10K MEG OHMS

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0% =	0.000	0.000	0.000	0.000	0.000	0.00	
20% =	6.003	6.006	6.005	6.005	6.005	20.01	
40% =	12.009	12.014	12.010	12.011	12.011	40.02	
60% =	18.014	18.013	18.020	18.016	18.016	60.03	
80% =	24.014	24.014	24.013	24.014	24.014	80.02	
100% =	30.007	30.017	30.003	30.009	30.009	100.00	
80% =	24.040	24.033	24.029	24.034	24.034	80.09	0.07
60% =	18.017	18.027	18.034	18.029	18.029	60.08	0.05
40% =	12.015	12.019	12.021	12.018	12.018	40.05	0.03
20% =	6.006	6.006	6.006	6.006	6.006	20.01	0.00
0% =	0.000	0.000	-0.002	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-1.239E-03 B=.300466 C= -3.58E-06
RR= .999999981



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER 206 870222 16 FEB 89
MANUFACTURER MODEL # SERIAL # DATE/APPROVAL
1000 PSIG N/A POS 10.0017 3.000 3
RANGE SL # / MODE EXCITATION V.DC. MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION	LINEARITY	HYSTERESIS
#1 = 25.02	100% = 100.00	80% = 0.07
#2 = 50.04	80% = 80.02	60% = 0.05
#3 = 75.08	60% = 60.03	40% = 0.03
#4 = 100.14	40% = 40.02	20% = 0.00
	20% = 20.01	0% = 0.00

TRANSDUCER CALIBRATION WORKSHEET

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OF POOR QUALITY

MANUFACTURER	MODEL	SERIAL NO.	RANGE	STEPS	SHUNTS	% OF F.S.
TABER	2210	842258	3000	1		
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT	2		
	15 FEB 89	10.00 VDC	16856	3		
BAROMETER	WPGOHMS TO GROUND	BATTERY	STANDARD	4		
			24412	5		
LOADING TECH.	RECORDING TECH.	COMPUTING TECH.	READ OUT	6		
16783	16783					
☐ DOUBLE SHUNT	SENSITIVITY	COMPRESSION F.S.	AVERAGE F.S.			
☐ SINGLE SHUNT	MV/V					
☐ RECEIVING INSP.	SHUNT MODULE	TENSION F.S.	CONVERSION FACTOR			
	MV/V					

LOADS	PSI	MV OUTPUT					AVERAGE	% OF F.S.	LIN	HYS
OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5				
0	0	.0000	.0000	.0000	.0000	.0000				
20	200	2.018	2.018	2.017	2.018	2.021				
40	400	4.040	4.043	4.038	4.038	4.041				
60	600	6.061	6.062	6.058	6.060	6.061				
80	800	8.081	8.082	8.079	8.080	8.075				
100	1000	10.101	10.102	10.099	10.098	10.103				
80	1200	12.116	12.118	12.117	12.115	12.120				
60	1400	14.134	14.132	14.130	14.135	14.131				
40	1600	16.145	16.143	16.144	16.142	16.140				
20	1800	18.150	18.152	18.157	18.160	18.155				
0	2000	20.160	20.168	20.165	20.162	20.160				
-20	2200	22.170	22.170	22.168	22.167	22.167				
-40	2400	24.160	24.163	24.173	24.165	24.168				
-60	2600	26.158	26.180	26.178	26.176	26.180				
-80	2800	28.170	28.176	28.173	28.171	28.172				
-100	3000	30.170	30.180	30.178	30.172	30.180				
-80										
-60										
-40										
-20										
-0										
Z OUT										

TRANSDUCER CALIBRATION WORKSHEET

DESCENDING

				STEPS	SHUNTS	% OF F.S.
MANUFACTURER TABER	MODEL 2210	SERIAL NO. 842258	RANGE 3000	1		
CHANNEL	CALIBRATION DATE 15 FEB 89	EXCITATION 10.00 VDC	LOADING INSTRUMENT 16856	2		
BAROMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24412	3		
LOADING TECH. 16783	RECORDING TECH. 16783	COMPUTING TECH.	READ OUT	4		
☐ DOUBLE SHUNT	SENSITIVITY	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	MV/V	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP.	SHUNT MODULE					
	MV/V					

APPLIED LOAD %	PSI	MV OUTPUT					AVERAGE	% OF F.S.	LN	HYS
Z OUT	input	Run 1	Run 2	Run 3	Run 4	Run 5				
0	3000	30.170	30.180	30.178	30.172	30.180				
20	2800	28.142	28.185	28.180	28.176	28.180				
40	2600	26.177	26.196	26.189	26.184	26.186				
60	2400	24.170	24.196	24.196	24.183	24.187				
80	2200	22.143	22.195	22.193	22.191	22.196				
100	2000	20.113	20.190	20.188	20.190	20.189				
80	1800	18.160	18.185	18.181	18.184	18.181				
60	1600	16.167	16.171	16.173	16.171	16.169				
40	1400	14.155	14.159	14.155	14.161	14.161				
20	1200	12.136	12.143	12.141	12.146	12.142				
0	1000	10.126	10.125	10.122	10.128	10.126				
-20	800	8.110	8.105	8.104	8.108	8.107				
-40	600	6.085	6.084	6.082	6.086	6.083				
-60	400	4.062	4.062	4.060	4.063	4.060				
-80	200	2.035	2.034	2.031	2.033	2.032				
-100	0	.0006	.0005	.0003	.0004	.0004				
-80										
-60										
-40										
-20										
-0										
Z OUT										

Appendix B
Pressure Calibration

TRANSDUCER CALIBRATION WORKSHEET

Ascending

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				STEPS	SHUNTS	% OF F.S.
MANUFACTURER Taser	MODEL 2210	SERIAL NO. 882181	RANGE 0 - 3000#	1	7.526	
CHANNEL	CALIBRATION DATE 17 Feb 87	EXCITATION 10.000VDC	LOADING INSTRUMENT 16851	2	15.057	
LOADMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24412	3	22.582	
LOADING TECH TCC 16783 STOS	RECORDING TECH TCC 16783 STOS	COMPUTING TECH.	READ OUT	4	30.107	
☐ DOUBLE SHUNT	SENSITIVITY	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INP						
APPLIED LOAD %				AVERAGE	% OF F.S.	LN
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5
0	0.000	0.000	0.000	0.000	0.000	
20	200	2.011	2.009	2.007	2.013	2.012
40	400	4.025	4.026	4.027	4.028	4.031
60	600	6.044	6.044	6.045	6.047	6.037
80	800	8.062	8.061	8.063	8.060	8.065
100	1000	10.077	10.074	10.080	10.081	10.081
80	1200	12.092	12.089	12.096	12.089	12.093
60	1400	14.102	14.100	14.107	14.103	14.108
40	1600	16.114	16.111	16.113	16.119	16.114
20	1800	18.122	18.118	18.125	18.128	18.115
0	2000	20.128	20.126	20.128	20.130	20.129
-20	2200	22.131	22.130	22.133	22.133	22.135
-40	2400	24.133	24.129	24.131	24.136	24.125
-60	2600	26.132	26.127	26.130	26.135	26.123
-80	2800	28.133	28.129	28.127	28.132	28.128
-100	3000	30.127	30.117	30.121	30.122	30.126
-80						
-60						
-40						
-20						
0						
Z OUT						

TRANSDUCER CALIBRATION WORKSHEET

Decending

				STEPS	SHUNTS	% OF F.S.		
MANUFACTURER <i>Teber</i>	MODEL <i>2210</i>	SERIAL NO. <i>882181</i>	RANGE <i>0-3000#</i>	1	<i>7.521</i>			
CHANNEL	CALIBRATION DATE <i>17 Feb 89</i>	EXCITATION <i>10.00VDC</i>	LOADING INSTRUMENT <i>16856</i>	2	<i>15.057</i>			
BAROMETER	MECHSMS TO GROUND	BATTERY	STANDARD <i>24412</i>	3	<i>22.582</i>			
LOADING TECH. <i>16783 STOS</i>	RECORDING TECH. <i>16783 STOS</i>	COMPUTING TECH.	READ OUT	4	<i>30.109</i>			
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.	5				
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR	6				
☐ RECEIVING INSP								
APPLIED LOAD %					AVERAGE	% OF F.S.	LN	HYS
Z OUT	<i>Indut</i>	<i>Run 1</i>	<i>Run 2</i>	<i>Run 3</i>	<i>Run 4</i>	<i>Run 5</i>		
0	<i>3000</i>	<i>30.127</i>	<i>30.117</i>	<i>30.121</i>	<i>30.122</i>	<i>30.126</i>		
20	<i>2800</i>	<i>28.130</i>	<i>28.125</i>	<i>28.136</i>	<i>28.134</i>	<i>28.130</i>		
40	<i>2600</i>	<i>26.128</i>	<i>26.132</i>	<i>26.145</i>	<i>26.147</i>	<i>26.140</i>		
60	<i>2400</i>	<i>24.135</i>	<i>24.142</i>	<i>24.150</i>	<i>24.152</i>	<i>24.137</i>		
80	<i>2200</i>	<i>22.140</i>	<i>22.138</i>	<i>22.153</i>	<i>22.146</i>	<i>22.135</i>		
100	<i>2000</i>	<i>20.145</i>	<i>20.148</i>	<i>20.150</i>	<i>20.151</i>	<i>20.147</i>		
80	<i>1800</i>	<i>18.155</i>	<i>18.146</i>	<i>18.146</i>	<i>18.148</i>	<i>18.152</i>		
60	<i>1600</i>	<i>16.145</i>	<i>16.137</i>	<i>16.142</i>	<i>16.140</i>	<i>16.145</i>		
40	<i>1400</i>	<i>14.134</i>	<i>14.124</i>	<i>14.133</i>	<i>14.130</i>	<i>14.135</i>		
20	<i>1200</i>	<i>12.127</i>	<i>12.119</i>	<i>12.120</i>	<i>12.119</i>	<i>12.123</i>		
0	<i>1000</i>	<i>10.107</i>	<i>10.109</i>	<i>10.104</i>	<i>10.106</i>	<i>10.109</i>		
-20	<i>800</i>	<i>8.096</i>	<i>8.089</i>	<i>8.092</i>	<i>8.088</i>	<i>8.092</i>		
-40	<i>600</i>	<i>6.074</i>	<i>6.070</i>	<i>6.070</i>	<i>6.068</i>	<i>6.072</i>		
-60	<i>400</i>	<i>4.053</i>	<i>4.051</i>	<i>4.049</i>	<i>4.047</i>	<i>4.050</i>		
-80	<i>200</i>	<i>2.034</i>	<i>2.029</i>	<i>2.026</i>	<i>2.027</i>	<i>2.030</i>		
-100	<i>0</i>	<i>0.007</i>	<i>0.002</i>	<i>0.003</i>	<i>0.001</i>	<i>0.004</i>		
-80								
-60								
-40								
-20								
-0								
Z OUT								

TRANSDUCER CALIBRATION WORKSHEET

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Ascending

MANUFACTURER		MODEL	SERIAL NO.	RANGE	STEPS	SHUNTS	% OF F.S.
Luber		2210	812258	0-3000 #	1	7.521	
CHANNEL		CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT	2	15.046	
		17 Feb 87	10.000VDC	16856			
BAROMETER		MEGOHMS TO GROUND	BATTERY	STANDARD	3	22.567	
				27467			
LOADING TECH.		RECORDING TECH.	COMPUTING TECH.	READ OUT	4	30.086	
☐ DOUBLE SHUNT ☐ SINGLE SHUNT ☐ RECEIVING INSP.		SENSITIVITY	COMPRESSION F.S.	AVERAGE F.S.	5		
		MV/V					
		SHUNT MODULE	TENSION F.S.	CONVERSION FACTOR	6		
		MV/V					

APPLIED LOAD %	INPUT	Run 1	Run 2	Run 3	Run 4	Run 5	AVERAGE	% OF F.S.	LN	HYS
0	0	2.000	0.000	0.000	0.000	0.000				
20	200	2.001	2.000	2.005	2.003	2.005				
40	400	4.005	4.005	4.010	4.006	4.008				
60	600	6.009	6.008	6.012	6.012	6.009				
80	800	8.013	8.009	8.010	8.011	8.012				
100	1000	10.013	10.011	10.014	10.015	10.015				
80	1200	12.011	12.010	12.014	12.010	12.015				
60	1400	14.009	14.007	14.012	14.014	14.012				
40	1600	16.007	16.001	16.006	16.009	16.006				
20	1800	18.001	17.996	18.005	18.004	18.000				
0	2000	19.995	19.990	19.996	19.994	19.994				
-20	2200	21.983	21.984	21.983	21.981	21.978				
-40	2400	23.975	23.970	23.969	23.971	23.965				
-60	2600	25.953	25.948	25.950	25.955	25.945				
-80	2800	27.943	27.938	27.941	27.939	27.930				
-100	3000	29.920	29.912	29.918	29.920	29.917				
-80										
-60										
-40										
-20										
0										
Z OUT										

TRANSDUCER CALIBRATION WORKSHEET

Decending

						STEPS	SHUNTS	% OF F.S.
MANUFACTURER Teber	MODEL 2210	SERIAL NO. 842258	RANGE 0-3000#	1	7.521			
CHANNEL	CALIBRATION DATE 17 Feb 87	EXCITATION 10.000VDC	LOADING INSTRUMENT 16.856	2	15.046			
BARDMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24467	3	22.567			
LOADING TECH. 16783 STDS	RECORDING TECH. 16783 STDS	COMPUTING TECH.	READ OUT	4	30.086			
☐ DOUBLE SHUNT	SENSITIVITY mV/V	COMPRESSION F.S.	AVERAGE F.S.	5				
☐ SINGLE SHUNT	SHUNT MODULE mV/V	TENSION F.S.	CONVERSION FACTOR	6				
☐ RECEIVING INSP								
APPLIED LOAD %					AVERAGE	% OF F.S.	LIN	NYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5		
0	3000	29.920	29.912	29.918	29.920	29.917		
-20	2800	27.925	27.920	27.930	27.941	27.932		
-40	2600	25.960	25.955	25.960	25.962	25.953		
-60	2400	23.982	23.973	23.980	23.979	23.968		
-80	2200	21.987	21.985	21.993	21.992	21.995		
-100	2000	20.010	20.004	20.008	20.005	20.005		
-80	1800	18.015	18.011	18.015	18.016	18.012		
-60	1600	16.022	16.015	16.023	16.022	16.018		
-40	1400	14.026	14.018	14.027	14.027	14.023		
-20	1200	12.031	12.024	12.030	12.027	12.033		
0	1000	10.026	10.028	10.029	10.029	10.031		
-20	800	8.030	8.025	8.024	8.023	8.033		
-40	600	6.023	6.022	6.024	6.017	6.024		
-60	400	4.018	4.015	4.016	4.016	4.016		
-80	200	2.009	2.009	2.008	2.007	2.011		
-100	0	0.003	0.003	0.001	0.002	0.002		
-80								
-60								
-40								
-20								
0								
Z OUT								

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TRANSDUCER WORKSHEET I AF 28 A1

MFG.: TABER
MODEL#: 206
SERIAL#: 848504
RANGE: 1000 PSIG
DATE: 17 FEB 89
SL#: N/A

READOUT: 24930

MODE: POS

REF STD: X1856

SHUNTS: 3 MV/V

INS RES: >10K MEG OHMS

3 MV/V SHUNTS -ZERO %F.S. SH/LIN
ZERO= 0.001 0.000
#1 = 7.524 7.525 25.07 25.04
#2 = 15.049 15.048 50.15 50.09
#3 = 22.572 22.571 75.27 75.17
#4 = 30.094 30.093 100.30 100.28

TEMP. DEG. F = 73

EXCITATION = 9.9965 V.DC

SENSITIVITY = 3.001 MV/V

POT OUT = 0.3060 MV

CONVERSION FACTOR = 3.33292598

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%	0.000	0.000	0.000	0.000	0.000	0.00	
20%	6.003	6.001	6.001	6.002	6.002	20.00	
40%	12.013	12.014	12.009	12.012	12.012	40.04	
60%	18.029	18.030	18.025	18.028	18.028	60.09	
80%	24.029	24.027	24.023	24.026	24.026	80.08	
100%	30.007	30.001	30.003	30.004	30.004	100.00	
80%	24.043	24.042	24.051	24.045	24.045	80.14	0.06
60%	18.048	18.046	18.046	18.047	18.047	60.15	0.06
40%	12.035	12.032	12.029	12.032	12.032	40.10	0.06
20%	6.009	6.003	6.008	6.007	6.007	20.02	0.02
0%	0.000	-0.003	-0.002	-0.002	-0.002	-0.01	-0.01

Y=A+BX+CX² A=-5.89299999E-03 B=.300912 C=-7.58E-06
RR= .999999567



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER 206 848504 17 FEB 89
MANUFACTURER MODEL # SERIAL # DATE/APPROVAL
1000 PSIG N/A POS 9.9965 3.001 3
RANGE SL # / MODE EXCITATION V.DC. MV/V SENS./ MV/V SHUNT MOD.



ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100%= 100.00	80%= 0.06
#1 = 25.04	80%= 80.08	60%= 0.06
#2 = 50.09	60%= 60.09	40%= 0.06
#3 = 75.17	40%= 40.04	20%= 0.02
#4 = 100.28	20%= 20.00	0%= -0.01

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER
MODEL #: 206
SERIAL #: 848504
RANGE: 1000 PSIG
DATE: 17 FEB 89
SL #: N/A
READOUT: 24930
MODE: POS
REF. STD: 16854
SHUNTS: 3 MV/V
INS. RES. >10K MEG OHMS

3 MV/V SHUNTS
ZERO = 0.000 0.000
#1 = 7.523 7.523 25.08 25.03
#2 = 15.046 15.046 50.16 50.09
#3 = 22.570 22.570 75.24 75.18
#4 = 30.091 30.091 100.31 100.30
TEMP. DEG. F = 73
EXCITATION = 9.9968 V.DC
SENSITIVITY = 3.001 MV/V
POT OUT = 0.3060 MV
CONVERSION FACTOR = 3.33362966

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%	0.000	0.000	0.000	0.000	0.000	0.00	
20%	6.001	6.000	6.002	6.001	6.001	20.01	
40%	12.016	12.019	12.014	12.016	12.016	40.06	
60%	18.026	18.021	18.025	18.024	18.024	60.09	
80%	24.019	24.013	24.023	24.018	24.018	80.07	
100%	29.998	29.998	29.996	29.997	29.997	100.00	
80%	24.032	24.034	24.036	24.034	24.034	80.12	-0.05
60%	18.044	18.042	18.039	18.042	18.042	60.14	0.05
40%	12.027	12.024	12.026	12.026	12.026	40.09	0.03
20%	6.005	6.009	6.008	6.007	6.007	20.03	-0.02
0%	0.000	0.000	-0.002	-0.001	-0.001	0.00	0.00

Y=A+BX+CX² A=-5.358E-03 B=.300932 C=-8.67E-06
RR= .999999733



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER
MANUFACTURER

206
MODEL #

848504
SERIAL #

17 FEB 89
DATE/APPROVAL

1000 PSIG
RANGE

N/A
SL # / MODE

POS
EXCITATION V.DC.

9.9968
MV/V SENS. / MV/V SHUNT MOD.

3.001
3



ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100%= 100.00	80%= 0.05
#1 = 25.03	80%= 80.07	60%= 0.05
#2 = 50.09	60%= 60.09	40%= 0.03
#3 = 75.18	40%= 40.06	20%= 0.02
#4 = 100.30	20%= 20.01	0%= 0.00

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER 3 MV/V SHUNTS -ZERO %F.S. SH/LIN
 MODEL#: 206 ZERO= 0.000 0.000
 SERIAL#: 870222 #1= 7.512 7.512 25.04 25.04
 RANGE: 1000 PSIG #2= 15.023 15.023 50.07 50.07
 DATE: 17 FEB 89 #3= 22.535 22.535 75.11 75.10
 SL#: N/A #4= 30.047 30.047 100.15 100.15
 READOUT: 24412 TEMP. DEG. F = 73
 MODE: POS EXCITATION = 10.0000 V.DC
 REF. STD: 16856 SENSITIVITY = 3.000 MV/V
 SHUNTS: 3 MV/V POT. OUT = 0.3450 MV
 INS. RES. >10K MEG OHMS CONVERSION FACTOR = 3.33303707

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%	0.000	0.000	0.000	0.000	0.000	0.00	
20%	5.995	5.992	5.996	5.994	5.994	19.98	
40%	11.998	11.995	11.997	11.997	11.997	39.99	
60%	18.006	18.010	18.004	18.007	18.007	60.02	
80%	24.015	24.012	24.010	24.012	24.012	80.03	
100%	30.003	30.001	30.004	30.003	30.003	100.00	
80%	24.021	24.018	24.025	24.021	24.021	80.06	0.03
60%	18.017	18.021	18.017	18.018	18.018	60.06	0.04
40%	12.014	12.010	12.012	12.012	12.012	40.04	0.05
20%	5.998	5.991	5.996	5.995	5.995	19.98	0.00
0%	0.000	-0.003	-0.002	-0.002	-0.002	-0.01	-0.01

Y=A+BX+CX^2 A=-3.81E-03 B=.30014 C=-3E-07
 RR= .999999785



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER 206 870222 17 FEB 89
 MANUFACTURER MODEL # SERIAL # DATE/APPROVAL
 1000 PSIG N/A POS 10.0000 3.000 3
 RANGE SL # / MODE EXCITATION V.DC. MV/V SENS./ MV/V SHUNT MOD.



ELECTRICAL SIMULATION	LINEARITY	HYSTERESIS
#1 = 25.04	100% = 100.00	80% = 0.03
#2 = 50.07	80% = 80.03	60% = 0.04
#3 = 75.10	60% = 60.02	40% = 0.05
#4 = 100.13	40% = 39.99	20% = 0.00
	20% = 19.98	0% = -0.01

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER 3 MV/V SHUNTS -ZERO %F.S. SH/LIN
 MODEL#: 206 ZERO= 0.000 0.000
 SERIAL#: 870222 #1 = 7.510 7.510 25.04 25.03
 RANGE: 1000 PSIG #2 = 15.021 15.021 50.07 50.07
 DATE: 17 FEB 89 #3 = 22.503 22.503 75.12 75.11
 SL#: N/A #4 = 30.044 30.044 100.15 100.15
 READOUT: 24412 TEMP.DEG.F = 73
 MODE: POS EXCITATION = 10.0003 V.DC
 REF.STD: 16856 SENSITIVITY = 3.000 MV/V
 SHUNTS: 3 MV/V POT OUT = 0.3440 MV
 INS.RES.>10K MEG OHMS CONVERSION FACTOR = 3.33359261

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%	0.000	0.001	0.000	0.000	0.000	0.00	
20%	5.992	5.994	5.993	5.993	5.993	19.98	
40%	12.000	12.006	12.000	12.002	12.002	40.01	
60%	18.002	18.004	18.004	18.003	18.003	60.01	
80%	24.003	24.000	24.008	24.004	24.003	80.02	
100%	29.997	29.998	29.999	29.998	29.998	100.00	
80%	24.014	24.014	24.013	24.014	24.013	80.05	0.03
60%	18.017	18.023	18.019	18.020	18.019	60.07	0.06
40%	12.009	12.006	12.009	12.008	12.008	40.03	0.02
20%	5.994	5.997	5.991	5.994	5.994	19.98	0.00
0%	-0.002	0.000	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX² A=-3.393E-03 B=.300148 C= -1.18E-06
 RR= .999999894



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER 206 870222 17 FEB 89
 MANUFACTURER MODEL # SERIAL # DATE/APPROVAL
 1000 PSIG N/A POS 10.0003 3.000 3
 RANGE SL # / MODE EXCITATION V.DC. MV/V SENS./ MV/V SHUNT MOD.



ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100%= 100.00	80%= 0.03
#1 = 25.03	80%= 80.02	60%= 0.06
#2 = 50.07	60%= 60.01	40%= 0.02
#3 = 75.11	40%= 40.01	20%= 0.00
#4 = 100.15	20%= 19.98	0%= 0.00

MORTON THIOKOL INC

Space Operations

Appendix C
Calibration After Maximum Pressure Test

TRANSDUCER CALIBRATION WORKSHEET

ASCENDING

				STEPS	SHUNTS	% OF F.S.
MANUFACTURER TABER	MODEL 2210	SERIAL NO. 882181	RANGE 0 - 3000 #	1	7.526	
CHANNEL	CALIBRATION DATE 19 FEB 89	EXCITATION 10.000 VDC	LOADING INSTRUMENT 16856	2	15.052	
BAROMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24412	3	22.575	
LOADING TECH 6962 STDS	RECORDING TECH. STDS	COMPUTING TECH.	READ OUT	4	30.094	
☐ DOUBLE SHUNT	SENSITIVITY	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP						

APPLIED LOAD %						AVERAGE	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5			
0	0	0.000	-0.001	0.000	0.000	0.000			
20	200	2.000	2.002	2.002	2.001	2.002			
40	400	4.007	4.006	4.007	4.008	4.009			
60	600	6.011	6.011	6.010	6.010	6.013			
80	800	8.015	8.012	8.012	8.017	8.016			
100	1000	10.016	10.017	10.017	10.018	10.018			
80	1200	12.020	12.017	12.017	12.018	12.018			
60	1400	14.017	14.015	14.016	14.016	14.017			
40	1600	16.014	16.015	16.013	16.015	16.014			
20	1800	18.011	18.008	17.992	18.009	18.009			
0	2000	20.004	20.002	20.000	20.003	20.002			
-20	2200	21.995	21.994	21.989	21.994	21.991			
-40	2400	23.982	23.982	23.975	23.983	23.980			
-60	2600	25.971	25.964	25.956	25.968	25.967			
-80	2800	27.953	27.936	27.951	27.950	27.950			
-100	3000	29.936	29.929	29.931	29.932	29.934			
-80									
-60									
-40									
-20									
-0									
Z OUT									

TRANSDUCER CALIBRATION WORKSHEET DESCENDING

MANUFACTURER TAGER	MODEL 2210	SERIAL NO. 882181	RANGE 0-3000 #	STEPS 1	SHUNTS	% OF F.S.
CHANNEL	CALIBRATION DATE 19 FEB 89	EXCITATION 10.000 VDC	LOADING INSTRUMENT 16856	2		
BAROMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24412	3		
LOADING TECH TC 882 SIDS	RECORDING TECH. 15952	COMPUTING TECH.	READ OUT	4		
☐ DOUBLE SHUNT	SENSITIVITY 3	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP						

APPLIED LOAD %					AVERAGE	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5		
0	3000	29.935	29.930	29.932	29.933	29.933		
20	2800	27.958	27.953	27.954	27.955	27.954		
40	2600	25.976	25.969	25.972	25.975	25.974		
60	2400	23.992	23.984	23.986	23.990	23.990		
80	2200	22.006	22.000	22.000	22.004	22.004		
100	2000	20.009	19.999	20.011	20.014	20.013		
80	1800	18.021	18.018	18.019	18.022	18.022		
60	1600	16.029	16.027	16.025	16.029	16.028		
40	1400	14.028	14.025	14.028	14.032	14.031		
20	1200	12.032	12.029	12.034	12.033	12.033		
0	1000	10.026	10.027	10.030	10.031	10.032		
-20	800	8.029	8.026	8.028	8.029	8.029		
-40	600	6.027	6.020	6.026	6.024	6.024		
-60	400	4.016	4.015	4.016	4.017	4.018		
-80	200	2.008	2.007	2.006	2.009	2.009		
-100	0	0.001	0.000	0.000	0.000	0.000		
-80								
-60								
-40								
-20								
-0								
Z OUT								

TRANSDUCER CALIBRATION WORKSHEET ASCENDING

MANUFACTURER TABER	MODEL 2210	SERIAL NO. 842258	RANGE 0-3000[#]	STEPS 1	Z-UNITS 7.586	% OF F.S.
CHANNEL	CALIBRATION DATE 19 FEB 89	EXCITATION 10.000 VDC	LOADING INSTRUMENT 16856	2	15.097	
BAROMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24467	3	22.627	
LOADING TECH. 16862 SIDS	RECORDING TECH. 16052	COMPUTING TECH.	READ OUT	4	30.156	
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP.						

APPLIED LOAD %						AVERAGE	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5			
0	0	0.000	0.000	0.000	0.000	0.000			
20	200	2.016	2.014	2.013	2.012	2.013			
40	400	4.032	4.027	4.029	4.029	4.031			
60	600	6.049	6.046	6.045	6.045	6.047			
80	800	8.065	8.057	8.061	8.063	8.062			
100	1000	10.079	10.077	10.075	10.076	10.076			
80	1200	12.096	12.088	12.088	12.090	12.091			
60	1400	14.105	14.099	14.100	14.098	14.102			
40	1600	16.117	16.113	16.111	16.111	16.112			
20	1800	18.126	18.117	18.105	18.116	18.117			
0	2000	20.130	20.121	20.117	20.121	20.123			
-20	2200	22.134	22.127	22.123	22.125	22.124			
-40	2400	24.134	24.126	24.123	24.126	24.124			
-60	2600	26.134	26.123	26.125	26.124	26.123			
-80	2800	28.128	28.103	28.121	28.118	28.118			
-100	3000	30.122	30.111	30.110	30.111	30.111			
-80									
-60									
-40									
-20									
-0									
Z OUT									

TRANSDUCER CALIBRATION WORKSHEET

DESCENDING

				STEPS	SHUNTS	% OF F.S.
MANUFACTURER TABER	MODEL 2210	SERIAL NO. 842268	RANGE 0-3000#	1		
CHANNEL	CALIBRATION DATE 19 FEB 89	EXCITATION 10.000 VDC	LOADING INSTRUMENT 16856	2		
BAROMETER	MEG OHMS TO GROUND	BATTERY	STANDARD 24467	3		
LOADING TECH 16962 SIDS	RECORDING TECH. 16962 SIDS	COMPUTING TECH.	READ OUT	4		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP.						

APPLIED LOAD %					AVERAGE	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5		
0	3000	30.124	30.111	30.112	30.111	30.111		
20	2800	28.135	28.122	28.125	28.124	28.123		
40	2600	26.145	26.130	26.132	26.134	26.132		
60	2400	24.146	24.134	24.137	24.137	24.139		
80	2200	22.151	22.139	22.140	22.141	22.143		
100	2000	20.142	20.129	20.139	20.140	20.140		
80	1800	18.144	18.132	18.136	18.137	18.139		
60	1600	16.141	16.132	16.130	16.132	16.133		
40	1400	14.127	14.118	14.120	14.123	14.123		
20	1200	12.121	12.109	12.114	12.111	12.113		
0	1000	10.101	10.095	10.099	10.099	10.100		
-20	800	8.092	8.083	8.085	8.083	8.084		
-40	600	6.078	6.063	6.070	6.067	6.065		
-60	400	4.053	4.045	4.047	4.045	4.047		
-80	200	2.023	2.023	2.025	2.024	2.024		
-100	0	0.012	0.002	0.003	0.000	0.001		
-80								
-60								
-40								
-20								
-0								
Z OUT								

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MFG.: TABER
MODEL#: 206
SERIAL#: 870222
RANGE: 1000 PSIG
DATE: 19 FEB 89
SL#: N/A
READOUT: 24412
MODE: POS
REF.STD: 16856
SHUNTS: 3 MV/V
INS.RES.>10K MEG OHMS

3 MV/V SHUNTS
ZERO= 0.000
#1 = 7.512
#2 = 15.024
#3 = 22.537
#4 = 30.049
TEMP.DEG.F = 73
EXCITATION = 10.0017 V.DC
SENSITIVITY = 3.000 MV/V
POT OUT = 0.3400 MV
CONVERSION FACTOR = 3.33262978

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0% =	0.000	0.000	0.000	0.000	0.000	0.00	
20% =	5.988	5.995	5.998	5.994	5.994	19.97	
40% =	12.002	11.999	12.002	12.001	12.001	39.99	
60% =	18.004	18.011	18.004	18.006	18.006	60.01	
80% =	24.012	24.010	24.019	24.014	24.014	80.03	
100% =	30.008	30.010	30.001	30.006	30.006	100.00	
80% =	24.022	24.024	24.029	24.025	24.025	80.07	0.04
60% =	18.028	18.029	18.018	18.025	18.025	60.07	0.06
40% =	12.010	12.017	12.007	12.011	12.011	40.03	0.04
20% =	5.998	5.996	5.999	5.998	5.998	19.99	0.02
0% =	-0.004	0.000	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.727E-03 B=.30016 C= -2.3E-07
RR= .99999984



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER MANUFACTURER	206 MODEL #	870222 SERIAL #	19 FEB 89 DATE/APPROVAL
1000 PSIG RANGE	N/A SL # / MODE	POS EXCITATION V.DC.	3.000 MV/V SENS. / 3 MV/V SHUNT MOD.



ELECTRICAL SIMULATION	LINEARITY	HYSTERESIS
#1 = 25.04	100% = 100.00	80% = 0.04
#2 = 50.07	80% = 80.03	60% = 0.06
#3 = 75.10	60% = 60.01	40% = 0.04
#4 = 100.13	40% = 39.99	20% = 0.02
	20% = 19.97	0% = 0.00

TRANSDUCER CALIBRATION REPORT

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MFG.: TABER
MODEL#: 206
SERIAL#: 870222
RANGE: 1000 PSIG
DATE: 19 FEB 89
SL#: N/A
READOUT: 24412
MODE: POS
REF. STD: 16856
SHUNTS: 3 MV/V
INS. RES. >10K MEG OHMS

3 MV/V SHUNTS
ZERO= 0.000
#1 = 7.512
#2 = 15.025
#3 = 22.537
#4 = 30.050

-ZERO 0.000
7.512
15.025
22.537
30.050

%F.S. 25.04
50.08
75.11
100.15

SH/LIN 25.03
50.06
75.10
100.14

TEMP. DEG. F = 73
EXCITATION = 10.0016 V.DC
SENSITIVITY = 3.000 MV/V
POT OUT = 0.3390 MV
CONVERSION FACTOR = 3.33288895

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0% =	0.000	0.000	0.001	0.000	0.000	0.00	
20% =	5.997	5.997	5.997	5.997	5.997	19.99	
40% =	11.998	11.999	12.008	12.002	12.001	40.00	
60% =	18.007	18.012	18.016	18.012	18.011	60.03	
80% =	24.007	24.016	24.016	24.013	24.013	80.03	
100% =	30.008	30.009	29.996	30.004	30.004	100.00	
80% =	24.037	24.028	24.032	24.032	24.032	80.10	0.07
60% =	18.030	18.028	18.024	18.027	18.027	60.08	0.05
40% =	12.012	12.007	12.020	12.013	12.013	40.04	0.04
20% =	6.003	5.999	6.006	6.003	6.002	20.01	0.02
0% =	0.000	-0.003	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.62E-03 B=.30029 C=-1.79E-06
RR= .999999841



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER
MANUFACTURER

206
MODEL #

870222
SERIAL #

19 FEB 89
DATE/APPROVAL

1000 PSIG
RANGE

N/A
SL # / MODE

POS
EXCITATION V.DC.

10.0016
3.000
NV/V SENS./ MV/V SHUNT MOD.

3



ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100% = 100.00	80% = 0.07
#1 = 25.03	80% = 80.03	60% = 0.05
#2 = 50.06	60% = 60.03	40% = 0.04
#3 = 75.10	40% = 40.00	20% = 0.02
#4 = 100.14	20% = 19.99	0% = 0.00

TRANSDUCER CALIBRATION REPORT

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MFG.: TABER 3 MV/V SHUNTS -ZERO %F.S. SH/LIN
MODEL#: 206 ZERO= 0.000 0.000
SERIAL#: 848504 #1 = 7.523 7.523 25.07 25.02
RANGE: 1000 PSIG #2 = 15.049 15.049 50.16 50.07
DATE: 19 FEB 89 #3 = 22.574 22.574 75.23 75.17
SL#: N/A #4 = 30.096 30.096 100.30 100.29
READOUT: 24412 TEMP.DEG.F = 73
MODE: POS EXCITATION = 9.9980 V.DC
REF.STD: 16856 SENSITIVITY = 3.001 MV/V
SHUNTS: 3 MV/V POT OUT = 0.3000 MV
INS.RES. >10K MEG OHMS CONVERSION FACTOR = 3.33281489

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0% =	0.000	0.000	0.000	0.000	0.000	0.00	
20% =	6.005	6.006	6.003	6.005	6.005	20.01	
40% =	12.015	12.017	12.029	12.020	12.020	40.06	
60% =	18.027	18.032	18.038	18.032	18.032	60.10	
80% =	24.023	24.031	24.033	24.029	24.029	80.08	
100% =	30.006	30.008	30.000	30.005	30.005	100.00	
80% =	24.060	24.050	24.050	24.053	24.053	80.17	0.09
60% =	18.054	18.051	18.047	18.051	18.051	60.16	0.06
40% =	12.029	12.025	12.038	12.031	12.031	40.10	0.04
20% =	6.012	6.008	6.016	6.012	6.012	20.04	0.03
0% =	0.000	-0.004	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-5.727E-03 B=.301141 C=-9.87E-06
RR= .999999658



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER 206 848504 19 FEB 89
MANUFACTURER MODEL # SERIAL # DATE/APPROVAL
1000 PSIG N/A POS 9.9980 3.001 3
RANGE SL # / MODE EXCITATION V.DC. MV/V SENS. / MV/V SHUNT MOD.

ELECTRICAL	LINEARITY	HYSTERESIS
SIMULATION	100% = 100.00	80% = 0.09
#1 = 25.02	80% = 80.08	60% = 0.06
#2 = 50.07	60% = 60.10	40% = 0.04
#3 = 75.17	40% = 40.06	20% = 0.03
#4 = 100.29	20% = 20.01	0% = 0.00

TRANSDUCER CALIBRATION REPORT

ORIGINAL PAGE IS
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MFG.: TABER
MODEL#: 206
SERIAL#: ~~870222~~ 848504
RANGE: 1000 PSIG
DATE: 19 FEB 89
SL#: N/A
READOUT: 24412
MODE: POS
REF.STD: 16856
SHUNTS: 3 MV/V
INS.RES. >10K MEG OHMS

3 MV/V SHUNTS
ZERO= 0.000
#1 = 7.525
#2 = 15.050
#3 = 22.576
#4 = 30.098
TEMP.DEG.F = 73
-ZERO 0.000
25.08
50.15
75.23
100.30
9.9981 V.DC
SENSITIVITY = 3.001 MV/V
POT OUT = 0.2990 MV
CONVERSION FACTOR = 3.33237065

LOAD	RUN ~~1~~ 4	RUN ~~2~~ 5	RUN ~~3~~ 6	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0% =	0.000	0.000	0.000	0.000	0.000	0.00	
20% =	6.001	6.001	6.006	6.003	6.003	20.00	
40% =	12.017	12.017	12.020	12.018	12.018	40.05	
60% =	18.024	18.034	18.027	18.028	18.028	60.08	
80% =	24.030	24.028	24.039	24.032	24.032	80.08	
100% =	30.008	30.013	30.005	30.009	30.009	100.00	
80% =	24.040	24.043	24.055	24.046	24.046	80.13	0.05
60% =	18.054	18.055	18.045	18.051	18.051	60.15	0.07
40% =	12.031	12.034	12.028	12.031	12.031	40.09	0.04
20% =	6.009	6.005	6.013	6.009	6.009	20.02	0.02
0% =	-0.002	-0.002	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-5.727E-03 B=.300993 C= -7.91E-06
RR= .999999615



CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER
MANUFACTURER

206
MODEL #

870222
SERIAL #

19 FEB 89
DATE/APPROVAL

1000 PSIG
RANGE

N/A
SL # / MODE

POS
EXCITATION V.DC.

9.9981
MV/V SENS. / MV/V SHUNT MOD.

3.001
3



ELECTRICAL SIMULATION	LINEARITY	HYSTERESIS
#1 = 25.04	100% = 100.00	80% = 0.05
#2 = 50.09	80% = 80.08	60% = 0.07
#3 = 75.17	60% = 60.08	40% = 0.04
#4 = 100.28	40% = 40.05	20% = 0.02
	20% = 20.00	0% = 0.00

TRANSDUCER CALIBRATION REPORT